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Introduction

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Introduction

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N.m.r. spectra in solids and viscous liquids are often broadened by dipolar interactions, which are normally so strong that effects due to chemical shifts and the weak scalar couplings are obscured. Means have therefore been sought to obtain high-resolution n.m.r. spectra from solids in ways that remove the broadening effect of dipole–dipole coupling.

One approach has been to use elaborate sequences of radio-frequency pulses designed to reduce the dipolar coupling, and a variety of methods have been demonstrated. These methods often reveal not only chemical shifts and exchange interactions, but also the full interaction tensor components of the crystalline state. Another approach has involved very rapid spinning of the sample about the 'magic angle', and of course this has also been combined with multiple pulse experiments. Another approach is to exploit multiple-quantum spectra by which the dipolar Hamiltonian is 'avoided rather than eliminated', in the words of A. Pines and his colleagues. Finally, there are elegant extensions and developments of the cross-polarization experiments of S. R. Hartmann and E. L. Hahn. All of these techniques can be combined in different ways to tease out the wealth of information in n.m.r. spectra of solid materials.

In this Discussion, these methods are described and reviewed by workers who have themselves been closely connected with their development. The scope and limitations of the different approaches are assessed and illustrated with specific examples, which include such measurements as the chemical shift tensors of protons, the chemical shifts of ^{13}C and ^{15}N n.m.r. in solid polymers, and of high-resolution n.m.r. spectra of the metabolic products of a bacterial fermentation of wood lignin, of organic and inorganic chemical crystals, and of solid biopolymers.

Those who were able to be present at the discussion felt that it was a splendid and authoritative assessment of the state of affairs in this new and very important development of the techniques of nuclear magnetic resonance. The organizers are indebted to the authors and speakers for making the meeting such a success. It is also a pleasure to acknowledge the great contribution made by the staff of the Royal Society, and in particular by Miss C. A. Johnson and Dr M. B. Goatly, who ensured that the arrangements were made as smoothly as ever.